

SEQUENCE LISTING

<110> Novozymes A/S

<120> Pullulanase variants and methods for preparing such variants with predetermined properties

<130> 6072

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<170> PatentIn version 3.0

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<211> 2766

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atc Ile	tat Tyr	gaa Glu 435	atg Met	gat Asp	gtc Val	cgt Arg	gac Asp 440	ttt Phe	tcc Ser	att Ile	gac Asp	cct Pro 445	aat Asn	tcg Ser	ggg Gly	1344
atg Met	aaa Lys 450	aat Asn	aaa Lys	ggg Gly	aag Lys	tat Tyr 455	ttg Leu	gct Ala	ctt Leu	aca Thr	gaa Glu 460	aaa Lys	gga Gly	aca Thr	aag Lys	1392
ggc Gly 465	cct Pro	gac Asp	aac Asn	gta Val	aag Lys 470	acg Thr	ggg Gly	ata Ile	gat Asp	tcc Ser 475	tta Leu	aaa Lys	caa Gln	ctt Leu	ggg Gly 480	1440
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ata Ile	aaa Lys 530	gag Glu	ttt Phe	aag Lys	gaa Glu	atg Met 535	gtt Val	ctt Leu	tca Ser	ctc Leu	cat His 540	cgt Arg	gaa Glu	cac His	att Ile	1632
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tct Ser	gac Asp	ttc Phe	gat Asp	aaa Lys 565	att Ile	gta Val	cca Pro	gaa Glu	tat Tyr 570	tat Tyr	tac Tyr	cgt Arg	acg Thr	gat Asp 575	gat Asp	1728
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gaa Glu	agg Arg	cca Pro 595	atg Met	gtt Val	caa Gln	aaa Lys	ttt Phe 600	att Ile	att Ile	gat Asp	tcc Ser	ctt Leu 605	aag Lys	tat Tyr	tgg Trp	1824
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ctt Leu 625	gga Gly	aaa Lys	gac Asp	acg Thr	atg Met 630	tcc Ser	aaa Lys	gct Ala	gcc Ala	tcg Ser 635	gag Glu	ctt Leu	cat His	gct Ala	att Ile 640	1920
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ggg Gly	cta Leu	atc Ile	cac His 820	ctt Leu	cgt Arg	ctt Leu	gat Asp	cac His 825	cca Pro	gcc Ala	ttc Phe	cgc Arg	atg Met 830	acg Thr	aca Thr	2496

gct aat gaa atc aat agc cac ctc caa ttc cta aat agt cca gag aac 2544
 Ala Asn Glu Ile Asn Ser His Leu Gln Phe Leu Asn Ser Pro Glu Asn
 835 840 845

aca gtg gcc tat gaa tta act gat cat gtt aat aaa gac aaa tgg gga 2592
 Thr Val Ala Tyr Glu Leu Thr Asp His Val Asn Lys Asp Lys Trp Gly
 850 855 860

aat atc att gtt gtt tat aac cca aat aaa act gta gca acc atc aat 2640
 Asn Ile Ile Val Val Tyr Asn Pro Asn Lys Thr Val Ala Thr Ile Asn
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ttg ccg agc ggg aaa tgg gca atc aat gct acg agc ggt aag gta gga 2688
 Leu Pro Ser Gly Lys Trp Ala Ile Asn Ala Thr Ser Gly Lys Val Gly
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gaa tcc acc ctt ggt caa gca gag gga agt gtc caa gta cca ggt ata 2736
 Glu Ser Thr Leu Gly Gln Ala Glu Gly Ser Val Gln Val Pro Gly Ile
 900 905 910

tct atg atg atc ctt cat caa gag gta agc cca gac cac ggt aaa aag 2784
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Ser Ala Asp Ile Pro Gly Asn Pro Ser Gln Val Gly Ile Ile Val Arg
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Thr Gln Asp Trp Thr Lys Asp Val Ser Ala Asp Arg Tyr Ile Asp Leu
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Ser Lys Gly Asn Glu Val Trp Leu Val Glu Gly Asn Ser Gln Ile Phe
 85 90 95

Tyr Asn Glu Lys Asp Ala Glu Asp Ala Ala Lys Pro Ala Val Ser Asn
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Ala Tyr Leu Asp Ala Ser Asn Gln Val Leu Val Lys Leu Ser Gln Pro

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Ala	Asn	Lys	Asp	Ile	Pro	Val	Thr	Ser	Val	Lys	Asp	Ala	Ser	Leu	Gly
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Gln	Asp	Val	Thr	Ala	Val	Leu	Ala	Gly	Thr	Phe	Gln	His	Ile	Phe	Gly
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Gly	Ser	Asp	Trp	Ala	Pro	Asp	Asn	His	Ser	Thr	Leu	Leu	Lys	Lys	Val
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Thr	Asn	Asn	Leu	Tyr	Gln	Phe	Ser	Gly	Asp	Leu	Pro	Glu	Gly	Asn	Tyr
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Phe	Ser	Tyr	Ile	Pro	Ser	Thr	His	Ala	Val	Tyr	Asp	Thr	Ile	Asn	Asn
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Pro	Asn	Ala	Asp	Leu	Gln	Val	Glu	Ser	Gly	Val	Lys	Thr	Asp	Leu	Val
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Thr	Val	Thr	Leu	Gly	Glu	Asp	Pro	Asp	Val	Ser	His	Thr	Leu	Ser	Ile
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Gln	Thr	Asp	Gly	Tyr	Gln	Ala	Lys	Gln	Val	Ile	Pro	Arg	Asn	Val	Leu
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Thr	Gln	Lys	Ala	Thr	Thr	Phe	Lys	Val	Trp	Ala	Pro	Thr	Ser	Thr	Gln
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Val	Pro	Met	Thr	Ala	Ser	Gly	His	Gly	Val	Trp	Glu	Ala	Thr	Val	Asn
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Gln	Asn	Leu	Glu	Asn	Trp	Tyr	Tyr	Met	Tyr	Glu	Val	Thr	Gly	Gln	Gly
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Gly Thr Arg Gly Met Ile Val Asp Leu Ala Lys Thr Asp Pro Ala Gly	405		410			415
Trp Asn Ser Asp Lys His Ile Thr Pro Lys Asn Ile Glu Asp Glu Val	420		425		430	
Ile Tyr Glu Met Asp Val Arg Asp Phe Ser Ile Asp Pro Asn Ser Gly	435		440		445	
Met Lys Asn Lys Gly Lys Tyr Leu Ala Leu Thr Glu Lys Gly Thr Lys	450		455		460	
Gly Pro Asp Asn Val Lys Thr Gly Ile Asp Ser Leu Lys Gln Leu Gly	465		470		475	480
Ile Thr His Val Gln Leu Met Pro Val Phe Ala Ser Asn Ser Val Asp	485		490		495	
Glu Thr Asp Pro Thr Gln Asp Asn Trp Gly Tyr Asp Pro Arg Asn Tyr	500		505		510	
Asp Val Pro Glu Gly Gln Tyr Ala Thr Asn Ala Asn Gly Asn Ala Arg	515		520		525	
Ile Lys Glu Phe Lys Glu Met Val Leu Ser Leu His Arg Glu His Ile	530		535		540	
Gly Val Asn Met Asp Val Val Tyr Asn His Thr Phe Ala Thr Gln Ile	545		550		555	560
Ser Asp Phe Asp Lys Ile Val Pro Glu Tyr Tyr Tyr Arg Thr Asp Asp	565		570		575	
Ala Gly Asn Tyr Thr Asn Gly Ser Gly Thr Gly Asn Glu Ile Ala Ala	580		585		590	
Glu Arg Pro Met Val Gln Lys Phe Ile Ile Asp Ser Leu Lys Tyr Trp	595		600		605	
Val Asn Glu Tyr His Ile Asp Gly Phe Arg Phe Asp Leu Met Ala Leu	610		615		620	
Leu Gly Lys Asp Thr Met Ser Lys Ala Ala Ser Glu Leu His Ala Ile	625		630		635	640
Asn Pro Gly Ile Ala Leu Tyr Gly Glu Pro Trp Thr Gly Gly Thr Ser	645		650		655	
Ala Leu Pro Asp Asp Gln Leu Leu Thr Lys Gly Ala Gln Lys Gly Met						

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Thr	Asp	Ala	Ile	Lys	Asn	Gly	Val	Glu	Gly	Ser	Ile	Asn	Asp	Phe	Thr
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Ser	Ser	Pro	Gly	Glu	Thr	Ile	Asn	Tyr	Val	Thr	Ser	His	Asp	Asn	Tyr
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Thr	Leu	Trp	Asp	Lys	Ile	Ala	Leu	Ser	Asn	Pro	Asn	Asp	Ser	Glu	Ala
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Asp	Arg	Ile	Lys	Met	Asp	Glu	Leu	Ala	Gln	Ala	Val	Val	Met	Thr	Ser
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Gln	Gly	Val	Pro	Phe	Met	Gln	Gly	Gly	Glu	Glu	Met	Leu	Arg	Thr	Lys
	770					775					780				
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785					790					795					800
Asp	Trp	Ser	Arg	Lys	Ala	Gln	Tyr	Pro	Asp	Val	Phe	Asn	Tyr	Tyr	Ser
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Gly	Leu	Ile	His	Leu	Arg	Leu	Asp	His	Pro	Ala	Phe	Arg	Met	Thr	Thr
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Thr	Val	Ala	Tyr	Glu	Leu	Thr	Asp	His	Val	Asn	Lys	Asp	Lys	Trp	Gly
	850					855					860				
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865					870					875					880
Leu	Pro	Ser	Gly	Lys	Trp	Ala	Ile	Asn	Ala	Thr	Ser	Gly	Lys	Val	Gly
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Glu	Ser	Thr	Leu	Gly	Gln	Ala	Glu	Gly	Ser	Val	Gln	Val	Pro	Gly	Ile
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<220>

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Asn Tyr Ala Asn Trp Asp Leu Trp Met Trp Pro Tyr Gln Pro Val Asn	
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ggg aat gga gca gca tac gag ttt tct gga aag gat gat ttt ggc gtt	144
Gly Asn Gly Ala Ala Tyr Glu Phe Ser Gly Lys Asp Asp Phe Gly Val	
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aaa gca gat gtt caa gtg cct ggg gat gat aca cag gta ggt ctg att	192
Lys Ala Asp Val Gln Val Pro Gly Asp Asp Thr Gln Val Gly Leu Ile	
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gtc cgt aca aat gat tgg agc caa aaa aat aca tca gac gat ctc cat	240
Val Arg Thr Asn Asp Trp Ser Gln Lys Asn Thr Ser Asp Asp Leu His	
65 70 75 80	
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Ile Asp Leu Thr Lys Gly His Glu Ile Trp Ile Val Gln Gly Asp Pro	
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Asn Ile Tyr Tyr Asn Leu Ser Asp Ala Gln Ala Ala Ala Thr Pro Lys	
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Val Ser Asn Ala Tyr Leu Asp Asn Glu Lys Thr Val Leu Ala Lys Leu	
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Thr Asn Pro Met Thr Leu Ser Asp Gly Ser Ser Gly Phe Thr Val Thr	
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Asp Lys Thr Thr Gly Glu Gln Ile Pro Val Thr Ala Ala Thr Asn Ala	
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Asn Ser Ala Ser Ser Glu Gln Thr Asp Leu Val Gln Leu Thr Leu	
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gcc agt gca ccg gat gtt tcc cat aca ata caa gta gga gca gcc ggt	576
Ala Ser Ala Pro Asp Val Ser His Thr Ile Gln Val Gly Ala Ala Gly	
180 185 190	
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Tyr Glu Ala Val Asn Leu Ile Pro Arg Asn Val Leu Asn Leu Pro Arg	

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Thr	Ala	Phe	Arg	Val	Trp	Ala	Pro	Thr	Ala	Ser	Asp	Val	Gln	Leu	Leu	
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Leu	Tyr	Asn	Ser	Glu	Thr	Gly	Pro	Val	Thr	Lys	Gln	Leu	Glu	Met	Gln	
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Lys	Ser	Asp	Asn	Gly	Thr	Trp	Lys	Leu	Lys	Val	Pro	Gly	Asn	Leu	Lys	
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Met	Ile	Val	Asp	Leu	Glu	Asp	Thr	Asn	Pro	Pro	Gly	Trp	Lys	Glu	Asp	
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Gly	Ala	Tyr	Ala	Thr	Thr	Pro	Glu	Gly	Thr	Ala	Arg	Ile	Thr	Gln	Leu	
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Lys	Gln	Leu	Ile	Gln	Ser	Ile	His	Lys	Asp	Arg	Ile	Ala	Ile	Asn	Met	
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gat	gtg	gtc	tat	aac	cat	acc	ttt	aac	gta	gga	gtg	tct	gat	ttt	gat	1392
Asp	Val	Val	Tyr	Asn	His	Thr	Phe	Asn	Val	Gly	Val	Ser	Asp	Phe	Asp	
	450					455					460					
aag	att	gtt	ccg	caa	tac	tat	tat	cgg	aca	gac	agc	gca	ggt	aat	tat	1440
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gtc Val	caa Gln	aag Lys	ttc Phe 500	gtt Val	ctg Leu	gat Asp	tct Ser	ggt Val 505	aaa Lys	tat Tyr	tgg Trp	gta Val	aag Lys 510	gaa Glu	tac Tyr	1536
cat His	atc Ile	gac Asp 515	ggc Gly	ttc Phe	cgt Arg	ttc Phe	gat Asp 520	ctt Leu	atg Met	gct Ala	ctt Leu	tta Leu 525	gga Gly	aaa Lys	gac Asp	1584
acc Thr	atg Met 530	gcc Ala	aaa Lys	ata Ile	tca Ser	aaa Lys 535	gag Glu	ctt Leu	cat His	gct Ala	att Ile 540	aat Asn	cct Pro	ggc Gly	att Ile	1632
gtc Val 545	ctg Leu	tat Tyr	gga Gly	gaa Glu	cca Pro 550	tgg Trp	act Thr	ggc Gly	ggt Gly	acc Thr 555	tct Ser	gga Gly	tta Leu	tca Ser	agc Ser 560	1680
gac Asp	caa Gln	ctc Leu	gtt Val	acg Thr 565	aaa Lys	ggt Gly	cag Gln	caa Gln	aag Lys 570	ggc Gly	ttg Leu	gga Gly	att Ile	ggc Gly 575	gta Val	1728
ttc Phe	aac Asn	gat Asp	aat Asn 580	att Ile	cgg Arg	aac Asn	gga Gly	ctc Leu 585	gat Asp	ggt Gly	aac Asn	gtt Val	ttt Phe 590	gat Asp	aaa Lys	1776
tcg Ser	gca Ala	caa Gln 595	gga Gly	ttt Phe	gca Ala	aca Thr	gga Gly 600	gat Asp	cca Pro	aac Asn	caa Gln	gtt Val 605	aat Asn	gtc Val	att Ile	1824
aaa Lys	aat Asn 610	aga Arg	gtt Val	atg Met	gga Gly	agt Ser 615	att Ile	tca Ser	gat Asp	ttc Phe	act Thr 620	tcg Ser	gca Ala	cct Pro	agc Ser	1872
gaa Glu 625	acc Thr	att Ile	aac Asn	tat Tyr	gta Val 630	aca Thr	agc Ser	cat His	gat Asp	aat Asn 635	atg Met	aca Thr	ttg Leu	tgg Trp	gat Asp 640	1920
aaa Lys	att Ile	agc Ser	gca Ala	agt Ser 645	aat Asn	ccg Pro	aac Asn	gat Asp	aca Thr 650	caa Gln	gca Ala	gat Asp	cga Arg	att Ile 655	aag Lys	1968
atg Met	gat Asp	gaa Glu	ttg Leu 660	gct Ala	caa Gln	gct Ala	gtg Val	gta Val 665	ttt Phe	act Thr	tca Ser	caa Gln	ggg Gly 670	gta Val	cca Pro	2016
ttt Phe	atg Met	caa Gln 675	ggt Gly	gga Gly	gaa Glu	gaa Glu	atg Met 680	ctg Leu	cgg Arg	aca Thr	aaa Lys	ggc Gly 685	ggt Gly	aat Asn	gat Asp	2064
aat Asn	agt Ser 690	tac Tyr	aat Asn	gcc Ala	ggg Gly	gat Asp 695	agc Ser	gtg Val	aat Asn	cag Gln	ttc Phe 700	gat Asp	tgg Trp	tca Ser	aga Arg	2112
aaa Lys 705	gca Ala	caa Gln	ttt Phe	gaa Glu	aat Asn 710	gta Val	ttc Phe	gac Asp	tac Tyr 715	tct Ser	tgg Trp	ttg Leu	att Ile	cat His 720		2160
cta Leu	cgt Arg	gat Asp	aat Asn	cac His 725	cca Pro	gca Ala	ttc Phe	cgt Arg	atg Met 730	acg Thr	aca Thr	gcg Ala	gat Asp	caa Gln 735	atc Ile	2208
aaa Lys	caa Gln	aat Asn	ctc Leu	act Thr	ttc Phe	ttg Leu	gat Asp	agc Ser	cca Pro	acg Thr	aac Asn	act Thr	gta Val	gca Ala	ttt Phe	2256

740					745					750						
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Glu	Leu	Lys	Asn	His	Ala	Asn	His	Asp	Lys	Trp	Lys	Asn	Ile	Ile	Val	
		755					760					765				
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Met	Tyr	Asn	Pro	Asn	Lys	Thr	Ala	Gln	Thr	Leu	Thr	Leu	Pro	Ser	Gly	
	770					775					780					
aat	tgg	aca	att	gta	gga	tta	ggc	aat	caa	gta	ggt	gag	aaa	tca	cta	2400
Asn	Trp	Thr	Ile	Val	Gly	Leu	Gly	Asn	Gln	Val	Gly	Glu	Lys	Ser	Leu	
	785				790					795					800	
ggc	cat	gta	aat	ggc	acg	gtt	gag	gtg	cca	gct	ctt	agt	acg	atc	att	2448
Gly	His	Val	Asn	Gly	Thr	Val	Glu	Val	Pro	Ala	Leu	Ser	Thr	Ile	Ile	
				805					810					815		
ctt	cat	cag	ggt	aca	tct	gaa	gat	gtc	att	gat	caa	aat				2487
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Gly Asn Gly Ala Ala Tyr Glu Phe Ser Gly Lys Asp Asp Phe Gly Val
 35 40 45

Lys Ala Asp Val Gln Val Pro Gly Asp Asp Thr Gln Val Gly Leu Ile
 50 55 60

Val Arg Thr Asn Asp Trp Ser Gln Lys Asn Thr Ser Asp Asp Leu His
 65 70 75 80

Ile Asp Leu Thr Lys Gly His Glu Ile Trp Ile Val Gln Gly Asp Pro
 85 90 95

Asn Ile Tyr Tyr Asn Leu Ser Asp Ala Gln Ala Ala Ala Thr Pro Lys
 100 105 110

Val Ser Asn Ala Tyr Leu Asp Asn Glu Lys Thr Val Leu Ala Lys Leu
 115 120 125

Thr Asn Pro Met Thr Leu Ser Asp Gly Ser Ser Gly Phe Thr Val Thr

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Asp 145	Lys Thr Thr Gly 150	Gln Ile Pro Val Thr 155
Ala Thr Asn Ala 160		
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Ala Ser Ala Pro 180	Asp Val Ser His Thr 185	Ile Gln Val Gly Ala Ala Gly 190
Tyr Glu Ala 195	Val Asn Leu Ile Pro 200	Arg Asn Val Leu Asn 205
Leu Pro Arg		
Tyr Tyr 210	Tyr Ser Gly Asn Asp 215	Leu Gly Asn Val Tyr 220
Ser Asn Lys Ala		
Thr 225	Ala Phe Arg Val Trp 230	Ala Pro Thr Ala Ser 235
Asp Val Gln Leu Leu 240		
Leu Tyr Asn Ser 245	Glu Thr Gly Pro Val Thr 250	Lys Gln Leu Glu Met 255
Gln		
Lys Ser Asp Asn 260	Gly Thr Trp Lys Leu 265	Lys Val Pro Gly Asn 270
Leu Lys		
Asn Trp Tyr 275	Tyr Tyr Leu Tyr Gln Val 280	Thr Val Asn Gly Lys 285
Thr Gln Thr		
Ala Val 290	Asp Pro Tyr Val Arg 295	Ala Ile Ser Val Asn 300
Ala Thr Arg Gly		
Met 305	Ile Val Asp Leu Glu 310	Asp Thr Asn Pro Pro 315
Gly Trp Lys Glu Asp 320		
His Gln Gln Thr 325	Pro Ala Asn Pro Val Asp 330	Glu Val Ile Tyr Glu 335
Val		
His Val Arg Asp 340	Phe Ser Ile Asp Ala 345	Asn Ser Gly Met Lys 350
Asn Lys		
Gly Lys Tyr 355	Leu Ala Phe Thr Glu 360	His Gly Thr Lys Gly 365
Pro Asp Asn		
Val Lys Thr Gly Ile Asp 370	Ser Leu Lys Glu Leu Gly 380	Ile Asn Ala Val
Gln Leu Gln Pro Ile 385	Glu Glu Phe Asn Ser Ile 395	Asp Glu Thr Gln Pro 400
Asn Met Tyr Asn Trp Gly Tyr Asp Pro Arg Asn Tyr Asn Val Pro Glu		

405								410				415			
Gly	Ala	Tyr	Ala 420	Thr	Thr	Pro	Glu	Gly 425	Thr	Ala	Arg	Ile	Thr 430	Gln	Leu
Lys	Gln	Leu 435	Ile	Gln	Ser	Ile	His 440	Lys	Asp	Arg	Ile	Ala 445	Ile	Asn	Met
Asp	Val 450	Val	Tyr	Asn	His	Thr 455	Phe	Asn	Val	Gly	Val 460	Ser	Asp	Phe	Asp
Lys 465	Ile	Val	Pro	Gln	Tyr 470	Tyr	Tyr	Arg	Thr	Asp 475	Ser	Ala	Gly	Asn	Tyr 480
Thr	Asn	Gly	Ser	Gly 485	Val	Gly	Asn	Glu	Ile 490	Ala	Thr	Glu	Arg	Pro 495	Met
Val	Gln	Lys	Phe 500	Val	Leu	Asp	Ser	Val 505	Lys	Tyr	Trp	Val	Lys 510	Glu	Tyr
His	Ile	Asp 515	Gly	Phe	Arg	Phe	Asp 520	Leu	Met	Ala	Leu	Leu 525	Gly	Lys	Asp
Thr	Met 530	Ala	Lys	Ile	Ser	Lys 535	Glu	Leu	His	Ala	Ile 540	Asn	Pro	Gly	Ile
Val 545	Leu	Tyr	Gly	Glu	Pro 550	Trp	Thr	Gly	Gly	Thr 555	Ser	Gly	Leu	Ser	Ser 560
Asp	Gln	Leu	Val	Thr 565	Lys	Gly	Gln	Gln	Lys 570	Gly	Leu	Gly	Ile	Gly 575	Val
Phe	Asn	Asp	Asn 580	Ile	Arg	Asn	Gly	Leu 585	Asp	Gly	Asn	Val	Phe 590	Asp	Lys
Ser	Ala	Gln 595	Gly	Phe	Ala	Thr	Gly 600	Asp	Pro	Asn	Gln	Val 605	Asn	Val	Ile
Lys	Asn 610	Arg	Val	Met	Gly	Ser 615	Ile	Ser	Asp	Phe	Thr 620	Ser	Ala	Pro	Ser
Glu 625	Thr	Ile	Asn	Tyr	Val 630	Thr	Ser	His	Asp	Asn 635	Met	Thr	Leu	Trp	Asp 640
Lys	Ile	Ser	Ala	Ser 645	Asn	Pro	Asn	Asp	Thr 650	Gln	Ala	Asp	Arg	Ile 655	Lys
Met	Asp	Glu	Leu 660	Ala	Gln	Ala	Val	Val 665	Phe	Thr	Ser	Gln	Gly 670	Val	Pro
Phe	Met	Gln	Gly	Gly	Glu	Glu	Met	Leu	Arg	Thr	Lys	Gly	Gly	Asn	Asp

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 Asn Ser Tyr Asn Ala Gly Asp Ser Val Asn Gln Phe Asp Trp Ser Arg
 690 695 700
 Lys Ala Gln Phe Glu Asn Val Phe Asp Tyr Tyr Ser Trp Leu Ile His
 705 710 715 720
 Leu Arg Asp Asn His Pro Ala Phe Arg Met Thr Thr Ala Asp Gln Ile
 725 730 735
 Lys Gln Asn Leu Thr Phe Leu Asp Ser Pro Thr Asn Thr Val Ala Phe
 740 745 750
 Glu Leu Lys Asn His Ala Asn His Asp Lys Trp Lys Asn Ile Ile Val
 755 760 765
 Met Tyr Asn Pro Asn Lys Thr Ala Gln Thr Leu Thr Leu Pro Ser Gly
 770 775 780
 Asn Trp Thr Ile Val Gly Leu Gly Asn Gln Val Gly Glu Lys Ser Leu
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